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I have this season had an opportunity to examine specimens and find as I expected, that it was *V. Woodii.* It is a well-marked species, easily distinguishable from *V. viride.*

Some of the specimens were 5 feet in height, the huge panicle over 2 feet in length.

In Patterson's catalogue but one locality is given for this plant, namely, Hancock County, collected by Mead. Will likely be found in other localities in the southern part of the State, where it should be expected.

I have specimens collected near St. Louis, Mo., by Letterman.

FRANK E. MCDONALD.

Reviews of Foreign Literature.

The Lichen Genus Cladonia. The above is the subject of an extremely interesting paper, published in the spring of 1891, by G. Krabbe, of the Univ. of Berlin.

The investigations for this work were begun in 1880, therefore covering a period of ten years. The work is very complete and exhaustive; studies in the field and laboratory combine to make the whole a thorough history of the development story of this genus. It was undertaken, the author says, in reference to three special features. First, the significance of the upright portion of the thallus or podetium; second the peculiar morphological significance of the polymorphism exhibited by this organ; third the question of sexuality which he claims can be studied here with more certainty than in other genera, because the development of the apothecia can be more easily traced here. In regard to the morphology of the podetium, there is a difference of opinion among lichenologists, some claiming it is the upright portion of the thallus, others that it is itself the thallus, and that the horizontal portion which precedes its formation in an organ corresponding to the protonema of the moss. Krabbe differs from both these views, and considers the podetium the homologue of the fruit body of the ascomycetes. In this way is found another argument for the double nature of the lichen, though this is now so generally recognized, that throughout the article the regular fungus forms are spoken of as the ascomycetes without algæ and the lichens, as ascomycetes with algæ.

The hyphæ forming the podetium rise from the gonidial layer of the thallus, branches grow from the latter upright or at right angles in little tufts, till they break through the rind. These he calls fruit primordials, and they often carry up with them in their growth some of the gonidia of the layer from which they started. Before the primordials have broken through the surface, the ascus bearing hyphæ may arise. It is not possible in all cases to distinguish exactly where a cell ceases to be an ordinary hypha and becomes an ascus. Certain cells increase in diameter, and as one follows them upward, they are seen to end in ascus cells or asci. In some cases it was certain that these ascus branches originated from the primordial or sterile branches.

He divides the whole genus in two classes, according to the relative time of the differentiation of the fruit hyphæ from the sterile ones, or perhaps more correctly, the time of the origin of the fruit hyphæ. When they originate early in the life of the fruit body, then the latter is inclined to remain more or less simple in form, so in this class are placed all having simply formed podetia. In the second class are all the cup, funnel, and variously branching forms. It is in this latter class that the polymorphism before referred to reaches its highest development. The podetium, he claims, has the same morphological significance as the fruit-body of the ordinary fungus. In the latter group of plants this organ is so uniform in shape in related species, that it is made the ground of classification. Here is the single genus *Cladonia*, it varies in shape from a small conical projection, through a series of different forms till it reaches a structure like that of a well branched tree. The causes of this branching are very carefully traced, so far as they may be considered of purely mechanical origin, such as unequal tensions coming from various causes. In connection with this comes what is termed various grades of sterility of the fruit-body. Of course, this expression can only be used on the assumption that the podetium is a fruit-body and not a thallus. It is well known that many of these bodies produce no spores, and in reference to this the author says, all grades of sterility may be found, from the extreme, where there is no differentiation of sterile and fertile threads, that is where the fruit primordials compose the whole podetium, from this extreme up to that where large and well developed asci are formed, but which fail to produce any spores.

The next and possibly most important question discussed is that of sexuality. It may be noticed here in passing, that without question, the belief that this feature occurs in any class of lichens, and in fact, in any of the higher fungi, is slowly losing ground. The adherents of this theory have been obliged to retreat from group to group, till they reached the Florideæ, or red sea-algæ, where the proofs of sex are still considered conclusive.

Krabbe says there is no possibility of sexuality in the genus *Cladonia*, that is to say, no possibility of fertilization accomplished in any manner with which we are acquainted. The only indication which might in any way imply such an act, he describes as follows: In some instances the ascus-hyphæ, when fully grown and swollen out, forming large cells, apparently for the development of spores within, lose their character as ascus-hyphæ, and turn back to sterile ones. This is brought about by the apical portion of the cell changing its manner of growth, becoming smaller in diameter, and stretching up until it somewhat resembles a trichogyn, and the enlarged part at the base resembles an ascogon. Now he says of this, the resemblance to the real ascogon and trichogyn of the Florideæ is very slight, and there are always two points of difference, these are the thread or tubular cell resembling the trichogyn, may branch, and it always starts gradually from that part which rasembles the ascogon. In both respects this is unlike the development of the true ascogon. It is hardly possible for those accustomed to the teachings of the text-books on general botany, and to the plates with the forked trichogyn of the Collemaceæ, taken from Stahl's work, to pass over this so lightly. The question will recur, what end is to be served by such a change of an organ.

The explanation of a certain element of the podetium forms a very striking feature of this most interesting article; that is, the presence of large numbers of soredia about the outer circumference of the podetia. The older writers on lichens regard these soredia as formed on this organ in the ordinary way by which this means of vegetative reproduction is accomplished. In short they consider it an argument in favor of the thallus nature of the podetium. In his description of them, the author says on the periphery of the fruit body there is often an entire mantle of these gonidia with their hyphæ threads, in other cases they are in little heaps. By following the development of these lichens it is seen that there is no possibility of these gonidia having originated from those in the thallus. This being admitted, there are only two other hypotheses possible. Either they must be the direct product of the hyphœ threads cut off by abstriction, or they must be foreign bodies which have found their way there from outside, and have clung there till the hyphæ on the outer part of the lichens have woven them in. The former hypothesis is untenable on the grounds that such a formation has never been observed, and this forms a strong argument for the fungus-alga theory of the lichen. If the gonidia were a direct outgrowth of the hyphæ threads they must have been found in the process of development. This leaves only one explanation, namely, that they are foreign bodies which have been borne to the podetium through the air. The author says there are many other indications of such an origin, and then discusses the question whether these little bodies come to the lichen already clothed with their hyphæ filaments, that is, as complete full grown soredia, or simply as naked algæ cells which afterward receive their covering from the lichen. He decides in favor of the former supposition, as only in two cases were naked algæ cells found on the lichen, and it was difficult to determine their fate. It was found that the outside surface of the podetium was loose in texture and thickly beset with little hooks curving over so that on the arrival of the soredia they were taken hold of and held fast, while the hyphæ threads from both soredia and podetium surface twine and interlace till complete union is formed. The philosophy of this curious arrangement is very evident. The podetium in its development grows by apical and intercalary growth in such a manner as to be unable to carry up the little providers of carbohydrates from the thallus below. So this lack is supplied from without apparently, in a purely accidental manner. There is, however, no more indications of accident than in many other instances, as, for example, pollination by wind-carried pollen grains.

To those who still doubt the compound nature of the lichen thallus this explanation of the origin and function of the outer gonidia of the podetium must seem extremely doubtful. For in this case not only is there a symbiosis between fungus and alga, according to the generally received notion of symbiosis, namely, where the parasite which is unable to get its own living lays hold of a host of suitable nature to supply its needs, and unites itself so closely to it as to become an integral part of it, but a second union occurs. Later on in the life of the plant, the fungus hyphæ, following their own manner of development, governed possibly by tendencies inherited from ancestors to whom the algæ were not a necessity, develop into an organ by such a manner of growth that it is impossible for them to carry with them their little supporters. This organ has an important function, that of furnishing spores to provide for the continuance of the species. Nature, ever ready with resources, now provides the little algæ from without, which in their turn seek out the plant requiring assistance, unite themselves to it, and "live forever afterward in peace and harmony." After all, this is no more wonderful than other processes which are held as well authenticated facts.

E. L. G.

Fontinalacees—Monographie des. J. Cardot. (Mem. Soc. Sci. Cherbourg, xxviii. 152 pages, 1892).

This work makes an epoch in the history of mosses, as the author claims for it the honor of being only the third monograph of a family of Bryophyta. Every type but one has been seen, and all the larger collections and exsiccatæ have been examined. The result is very satisfactory. Six genera are recognized, of which three, *Fontinalis*, *Brachelyma* and *Dichelyma*, are North American. Thirty-three species of *Fontinalis* with twenty-one in North America, adds ten to the number included in Lesquereux and James' Manual. The species are ranked in four grades, according to their importance—*F. antipyretica*, *F. biformis*, *F. disticha*, *F. Novæ-Angliæ*, *F. hypnoides*, *F. microdonta*, *F. dichelymoides* and *F. filiformis* taking first rank, whereas most of the new species rank third and fourth, *F. maritima*, *F. Kindbergii*, *F. Howellii*, *F. chrysophylla*, *F. Delamarei*, *F. mollis*, *F. Cardoti*, *F. involuta*, *F. tenella*, *F. Duriæi*, *F. flaccida* and *F. Langloisii* being additions to our list. *Dichelyma subulatum* is changed to *Brachelyma*, and *D. Swartzii* is reduced to *Hypnum fluitans*.

E. G. B.

Enumeratio Muscorum Caucasi. V. F. Brotherus. (Acta Soc. Sci. Fenn. xix. 170 pp. quarto, 1892).

This beautiful memoir is a very important contribution to geographical Bryology, and of much interest to American students, many of the species occuring on this side of the Atlantic.

Although the author claims to follow Lindberg in the nomenclature, we notice several discrepancies, which are interesting, as being also unlike Braithwaite's accepted names—*Encalypta* for *Leersia*, *Mnium* for *Astrophyllum*, *Ulota* for *Weissia*, *Orthotrichum* for *Dorcadion* and *Amphidium* for *Anœtangium*. The descriptions of new species are by Lindberg, Brotherus, Muller and Venturi, twenty-four Acrocarpi and ten Pleurocarpi being characterized. Four hundred and twenty Musci, six *Sphagna* and thirty-four Hepaticæ are listed. E. G. B.

Index to Recent Literature Relating to American Botany.

Ægagropilen—Ueber. G. Lagerheim. (Nuova Notarisia, iii. 89-95).

Albinos among Orchids. Anna Murray Vail. (Gard. and For. v. 395).

Amarantus crassipes. John M. Holzinger. (Bot. Gaz. xvii. 254-256, one plate).

Arisœma triphyllum—On the Development of the Embryo-sac of. D. M. Mottier. (Bot. Gaz. xvii. 258-260; one plate).

Aster amethystinus. (Gard. and For. v. 377, with figure).

This illustration, it is claimed, is the first ever published of the above species.

Botanical Tramp—A Rocky Mountain. F. D. Kelsey. (Zoë, iii., 108-113).

An account of the plants observed in a botanical excursion in the vicinity of Helena, Mont.

Botrychium Virginianum—On the Apical Growth of the Stem